PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
PE17446PC00		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2003/001427	11-09-2003	
International Patent Classification (IPC) or national classification and IPC		
H04L12/56 H04Q11/04		
Applicant		
Telefonaktiebolaget LM Ericsson (publ) et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 9 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))
      _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11-04-2005	20-09-2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Lisbeth Andersson /LR Telephone No. +46 8 782 25 00

Form PCT/IPEA/409 (cover sheet) (April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE2003/001427

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-31 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 32-40 received by this Authority on 22-08-2005
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-14 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing *(specify)*: _____
- ☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing *(specify)*: _____
- ☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE2003/001427

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-29	YES
	Claims		NO
Inventive step (IS)	Claims	1-29	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-29	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

This report is based on the amended claims 1-29 received by this Authority on 22-08-2005.

Documents cited in the International Search Report:

D1: US 6567378 B1
D2: EP 1100285 A1
D3: WO 0193598 A2
D4: Database WPI, Week 200128, Derwent Publications Ltd, London, GB; H04L 12/28, AN 2001-27444, & JP 2001 057556 (NIPPON DENKI ENG KK), 27 February 2001 (2001-02-27)
D5: Database WPI, Week 200030, Derwent Publications Ltd, London, GB; Class H04L 12/28, AN 2001-153479, & JP 2000 013390 (NEC CORP), 14 January 2000 (2000-01-14)

The problem to be solved, according to the applicant, is to provide efficient management of data packets and to enable identification of complete data packets in data buffers comprising segments of data packets in a base station system of a mobile communications system [see the description on page 2 lines 16-27].

D1, which is considered to represent the most relevant prior art, describes a method for selectively discarding packets, each having a plurality of cells, in a queuing buffer in a cell relay network. The method comprises the steps of determining the total number of cells in a packet, deciding if the buffer capacity is sufficient, and discarding the cells of the packet if the buffer capacity is insufficient [see the abstract, figures 5A and 5B, and claims 1, 6 and 8].

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

D2 describes a method of managing data packets originating from data frames in e.g. a base station system in a GSM or UMTS network. The method comprises the steps of determining the start of a frame in a queuing buffer, deciding if the buffer capacity is sufficient (i.e. determining whether the filling level of the buffer exceeds a first predetermined filling threshold), and systematically discarding all the packets belonging to that same frame if the buffer capacity is insufficient [see the abstract, figures 4 and 7, claim 1, and paragraphs 0004-0005].

In both D1 and D2, the buffer needs information to be able to decide which segments belong to the same packet. This information is received via an identifier from a node segmenting packets [see column 3 line 54 to column 4 line 8 in D1, and claim 6 in D2].

The invention defined in the claims 1-29 differs from what is known in D1 and D2 in that D1 and D2 do not describe the usage of the relative sizes of data packet segments (cells) in the data buffer in order to identify a complete data packet in the buffer. The present invention therefore provides e.g. the advantage of reducing the amount of control (header) data that each data segment has to include, which in turn increases the system throughput.

The cited documents D1-D5 represent the general state of the art. The invention defined in claims 1-29 is not disclosed by any of these documents. The cited prior art does not give any indication that would lead a person skilled in the art to the claimed method and system for identifying complete data packets in data buffers comprising segments of data packets. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-29 is novel and is considered to involve an inventive step. The invention is industrially applicable.

CLAIMS

1. A method of managing a data buffer (120) comprising a queue of consecutive segments of data packets in a base station system (100) of a mobile communications system (1), comprising the steps of:

- said base station system (100) comparing a size (S(k)) of a data packet segment (P(k)) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120);
- said base station system (100) identifying said complete data packet based on said comparison; and
- said base station system (100) discarding said identified complete data packet from said buffer (120).

2. The method according to claim 1, wherein said identifying step comprises the steps of:

- identifying said next data packet segment (P(k+1)) as a first data packet segment (P(FIRST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) is smaller than said size (S(k+1)) of said next data packet segment (S(k+1)); and
- associating said identified first data packet segment (P(FIRST)) with a first segment identifier (FIRST).

3. The method according to claim 1, wherein said identifying step comprises the steps of:

- identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) differs from said size (S(k+1)) of said next data packet segment (P(k+1)); and
- associating said identified last data packet segment (P(LAST)) with a last segment identifier (LAST).

4. The method according to claim 2 and 3, wherein said discarding step comprises the step of discarding said data packet segment (P(FIRST)) associated with said first segment identifier (FIRST), said data packet segment

PCT / SE 2003 / 0 0 1 4 2 7
2 2 -08- 2005

(P(LAST)) associated with said last segment identifier (LAST) and any intermediate data packet segments between said data packet segment (P(FIRST)) associated with said first segment identifier (FIRST) and said data packet segment (P(LAST)) associated with said last segment identifier (LAST) in said buffer (120).

5. A system (130) for managing a data buffer (120) comprising a queue of consecutive segments of data packets in a base station system (100) of a mobile communications system (1), comprising:

- means (146) for comparing a size (S(k)) of a data packet segment (P(k)) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120);
- means (140) for identifying said complete data packet based on said comparison; and
- means (136) for discarding said identified complete data packet from said buffer (120).

6. The system according to claim 5, wherein said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a first data packet (P(FIRST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) is smaller than said size (S(k+1)) of said next data packet segment (P(k+1)), said system (130) further comprises means (142) for associating said identified first data packet segment (P(FIRST)) with a first segment identifier (FIRST).

7. The system according to claim 5, wherein said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) differs from said size (S(k+1)) of said next data packet segment (P(k+1)), said system (130) further comprises means (142) for associating said identified last data packet segment (P(LAST)) with a last segment identifier (LAST).

8. The system according to claim 6 and 7, wherein said discarding means (136) is adapted for discarding said data packet segment (P(FIRST)) associated with said first segment identifier (FIRST), said data packet segment (P(LAST)) associated with said last segment identifier (LAST) and any intermediate data packet segments between said data packet segment (P(FIRST)) associated with said first segment identifier (FIRST) and said data packet segment (P(LAST)) associated with said last segment identifier (LAST) in said buffer (120).

9. A base station network node of a base station system (100) in a mobile communications system (1) comprising:

- a data buffer (120) comprising a queue of consecutive segments of data packets; and
- a system (130) for managing said data buffer (120) according to any of the claims 5 to 8.

10. A method of enabling identification of a complete data packet in a data buffer (120) comprising a queue of consecutive data packet segments, comprising the steps of:

- comparing a size (S(k)) of a data packet segment (P(k)) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120); and
- identifying said complete data packet based on said comparison.

11. The method according to claim 10, further comprising the step of providing a segment counter (k) associated with a data packet segment (P(k)) in said buffer (120).

12. The method according to claim 11, further comprising the steps of:

- comparing a size (S(k)) of said data packet segment (P(k)) associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120);
- identifying said next data packet segment (P(k+1)) as a first data packet segment (P(FIRST)) of said complete data packet in said buffer (120) if

said size (S(k)) of said data packet segment (P(k)) associated with said counter (k) is smaller than said size (S(k+1)) of said next data packet segment (P(k+1)).

13. The method according to claim 11, further comprising the steps of:

(a) comparing a size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120); and

(b) associating said counter (k) with said next data packet segment (P(k+1)) if said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) is equal to or larger than said size (S(k+1)) of said next data packet segment (P(k+1)); and

- repeating both said comparison step (a) and said associating step (b) until said size (S(k)) of the data packet (P(k)) currently associated with said counter (k) is smaller than said size (S(k+1)) of said next data packet segment (P(k+1)), whereby said next data packet segment (P(k+1)) is identified as a first data packet segment (P(FIRST)) of said complete data packet in said buffer (120).

14. The method according to claim 12 or 13, further comprising the step of associating said segment counter (k) with said first data packet segment (P(FIRST)) of said complete data packet.

15. The method according to claim 14, further comprising the steps of:

- comparing a size (S(k)) of said data packet segment (P(k)) associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120); and

- identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) associated with said counter (k) differs from said size (S(k+1)) of said next data packet segment (P(k+1)).

16. The method according to claim 15, wherein said complete data packet is identified as comprising said first data packet segment (P(FIRST)) of said

complete data packet, said last data packet segment (P(LAST)) of said complete data packet and any intermediate data packet segments between said first (P(FIRST)) and last (P(LAST)) data packet segment of said complete data packet in said buffer (120).

17. The method according to claim 15, further comprising the steps of:

- determining a total size of said first data packet segment (P(FIRST)) of said complete data packet, said last data packet segment (P(LAST)) of said complete data packet and any intermediate data packet segments between said first (P(FIRST)) and last (P(LAST)) data packet segment of said complete data packet in said buffer (120);
- comparing said total size with a minimum size threshold; and
- identifying said complete data packet as comprising said first data packet segment (P(FIRST)) of said complete data packet, said last data packet segment (P(LAST)) of said complete data packet and any intermediate data packet segments between said first (P(FIRST)) and last (P(LAST)) data packet segment of said complete data packet in said buffer (120) if said total size is larger than said minimum size threshold.

18. The method according to claim 11, further comprising the steps of:

- comparing a size (S(k)) of said data packet segment (P(k)) associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120); and
- identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) associated with said counter (k) differs from said size (S(k+1)) of said next data packet segment (P(k+1)).

19. The method according to claim 11, further comprising the steps of:

(c) comparing a size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120);

(d) associating said counter (k) with said next data packet segment (P(k+1)) if said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) is equal to said size (S(k)) of said next data packet segment (P(k+1)); and

- repeating both said comparison step (c) and said associating step (d) until said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) differs from said size (S(k+1)) of said next data packet segment (P(k+1)), whereby said next data packet segment (P(k+1)) is identified as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120).

20. A system (140) for enabling identification of a complete data packet in a data buffer (120) comprising a queue of consecutive data packet segments, comprising:

- means (146) for comparing a size (S(k)) of a data packet segment (P(k)) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120); and

- means (140) for identifying said complete data packet based on said comparison.

21. The system according to claim 20, comprising means (142) for associating a segment counter (k) with a data packet segment (P(k)) in said buffer (120).

22. The system according to claim 21, wherein said comparison means (146) is adapted for comparing a size (S(k)) of said data packet segment (P(k)) associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120), wherein said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a first data packet segment (P(FIRST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) associated with said counter (k) is smaller than said size (S(k+1)) of said next data packet segment (P(k+1)).

23. The system according to claim 21, wherein said comparison means (146) is adapted for comparing a size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120), wherein said associating means (142) is adapted for associating said counter (k) with said next data packet segment (P(k+1)) if said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) is equal to or larger than said size (S(k+1)) of said next data packet segment (P(k+1)), said comparison means (146) is adapted for repeating said size comparison and said associating means (142) is adapted for repeating said counter association until said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) is smaller than said size (S(k+1)) of said next data packet segment (P(k+1)), whereby said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a first data packet segment (P(FIRST)) of said complete data packet in said buffer (120).

24. The system according to claim 22 or 23, wherein said associating means (142) is adapted for associating said segment counter (k) with said first data packet segment (P(FIRST)) of said complete data packet.

25. The system according to claim 24, wherein said comparison means (146) is adapted for comparing a size (S(k)) of said data packet segment (P(k)) associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120), wherein said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) associated with said counter (k) differs from said size (S(k+1)) of said next data packet segment (P(k+1)).

26. The system according to claim 25, wherein said identifying means (140) is adapted for identifying said complete data packet as comprising said first data packet segment (P(FIRST)) of said complete data packet, said last data packet

segment (P(LAST)) of said complete data packet and any intermediate data packet segments between said first (P(FIRST)) and last (P(LAST)) data packet segment of said complete data packet in said buffer (120).

27. The system according to claim 25, further comprising means (142) for determining a total size of said first data packet segment (P(FIRST)) of said complete data packet, said last data packet segment (P(LAST)) of said complete data packet and any intermediate data packet segments between said first (P(FIRST)) and last (P(LAST)) data packet segment of said complete data packet in said buffer (120), said comparison means (146) is adapted for comparing said total size with a minimum size threshold, and said identifying means (140) is adapted for identifying said complete data packet as comprising said first data packet segment (P(FIRST)) of said complete data packet, said last data packet segment (P(LAST)) of said complete data packet and any intermediate data packet segments between said first (P(FIRST)) and last (P(LAST)) data packet segment of said complete data packet in said buffer (120) if said total size is larger than said minimum size threshold.

28. The system according to claim 21, wherein said comparison means (146) is adapted for comparing a size (S(k)) of said data packet segment (P(k)) associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120), wherein said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120) if said size (S(k)) of said data packet segment (P(k)) associated with said counter (k) differs from said size (S(k+1)) of said next data packet segment (P(k+1)).

29. The system according to claim 21, wherein said comparison means (146) is adapted for comparing a size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) with a size (S(k+1)) of a next consecutive data packet segment (P(k+1)) in said buffer (120), wherein said associating means (142) is adapted for associating said counter (k) with said

next data packet segment (P(k+1)) if said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) is equal to said size (S(k+1)) of said next data packet segment (P(k+1)), said comparison means (146) is adapted for repeating said size comparison and said associating means (142) is adapted for repeating said counter associating until said size (S(k)) of the data packet segment (P(k)) currently associated with said counter (k) differs from said size (S(k+1)) of said next data packet segment (P(k+1)), whereby said identifying means (140) is adapted for identifying said next data packet segment (P(k+1)) as a last data packet segment (P(LAST)) of said complete data packet in said buffer (120).